

## Claims

- [c1] A welding apparatus for a welding process in a straight polarity configuration comprising:
- a welding gun having means for feeding an electrode into the welding gun;
- the electrode comprising a sheath encapsulating a core having a core composition, the core composition comprising a combination of graphite and one or more compounds of potassium, the combination of graphite and compounds of potassium in the core composition not exceeding approximately 5% by weight; and
- a power source supplying electrical current to the electrode.
- [c2] 2.The welding apparatus of Claim 1, further comprising a gas source supplying a shielding gas to the welding apparatus.
- [c3] 3.The welding apparatus of Claim 1, wherein the welding process is gas metal arc welding.
- [c4] 4.The welding apparatus of Claim 1, wherein the means for feeding the electrode into the welding gun comprise a wire drive and a wire reel.
- [c5] 5.The welding apparatus of Claim 1, wherein one or more compounds of potassium comprise  $K_2 MnTiO_4$  and  $K_2 SO_4$ .
- [c6] 6.The welding apparatus of Claim 5, wherein the combination is selected from the range from about 0.3% to about 5.0%.
- [c7] 7.The welding apparatus of Claim 2, wherein the shielding gas comprises a mixture of Ar and  $CO_2$ .
- [c8] 8.A wire comprising a sheath encapsulating a core having a core composition, the core composition comprising a combination of graphite and one or more compounds of potassium, the combination of graphite and compounds of potassium in the core composition not exceeding approximately 5% by weight.
- [c9] 9.The wire of Claim 8, wherein the compounds of potassium comprise  $K_2 MnTiO_4$  and  $K_2 SO_4$ .

- [c10] 10. The wire of Claim 8, wherein the combination of graphite and one or more compounds of potassium in the core composition is selected from the range of about 0.3% to about 5% by weight.
- [c11] 11. The wire of Claim 10, wherein the compounds of potassium comprise  $K_2MnTiO_4$  and  $K_2SO_4$ .
- [c12] 12. A process of manufacturing a metal-cored wire comprising:  
shaping a metal sheath into a fillable shape;  
filling the sheath with a core composition to form a core, the core composition comprising a combination of graphite and one or more compounds of potassium, the combination not exceeding approximately 5% by weight; and  
encapsulating the core by the sheath to form a metal-cored wire.
- [c13] 13. The process of Claim 12, wherein the compounds of potassium comprise  $K_2MnTiO_4$  and  $K_2SO_4$ .
- [c14] 14. The process of Claim 12, wherein the core composition is a powder.
- [c15] 15. The process of Claim 12, wherein the combination is selected from a range of about 0.3% to about 5.0% by weight.
- [c16] 16. The process of Claim 15, wherein the compounds of potassium comprise  $K_2MnTiO_4$  and  $K_2SO_4$ .
- [c17] 17. A welding process in a straight polarity configuration comprising:  
providing a welding apparatus having means for feeding an electrode into the welding apparatus and means for supplying a shielding gas into the welding apparatus;  
coupling the welding apparatus to a power source in the straight polarity configuration and forming an arc;  
feeding the electrode into the welding apparatus, the electrode comprising a sheath and a core having a core composition, the core composition comprising a combination of graphite and one or more compounds of potassium, the combination of graphite and compounds of potassium in the core composition not exceeding approximately 5% by weight; and

supplying the shielding gas into the welding apparatus to shield the electrode and the arc.

[c18] 18.The welding process of Claim 17, wherein supplying the shielding gas into the welding apparatus comprises providing an external gas source.

[c19] 19.The welding process of Claim 17, wherein feeding the electrode into the welding apparatus comprises providing means for feeding the electrode that is external to the welding apparatus.

[c20] 20.The welding process of Claim 17, wherein supplying the shielding gas comprises providing a mixture of Ar and  $\text{CO}_2$ .

[c21] 21.The welding process of Claim 17, wherein the welding process is a gas metal arc welding process.

[c22] 22.The welding process of Claim 17, wherein one or more compounds of potassium comprise  $\text{K}_2\text{MnTiO}_4$  and  $\text{K}_2\text{SO}_4$ .

[c23] 23.The welding process of Claim 22, wherein the combination is selected from the range from about 0.3% to about 5.0%.